

Exhibit 827-4

3GPP TS 29.212 V8.3.0 (2009-03)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Policy and Charging Control over Gx reference point (Release 8)



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4.5.4.2 Provisioning of Default Charging Method

The default charging method indicates what charging method shall be used for every PCC rule where the charging method is omitted. The PCEF may have a pre-configured Default charging method.

Upon the initial interaction with the PCRF, the PCEF shall provide the pre-configured Default charging method if available within the Online AVP and/or Offline AVP embedded directly within the CCR command to the PCRF.

Upon the initial interaction with the PCEF, the PCRF may provide default charging method within the Online AVP or Offline AVP embedded directly within the CCA command to the PCEF. The default charging method provided by the PCRF shall overwrite any predefined default charging method at the PCEF.

4.5.5 Provisioning and Policy Enforcement of Authorized QoS

4.5.5.0 Overview

The PCRF may provide authorized QoS to the PCEF.

The authorized QoS shall be provisioned within a CCA or RAR Diameter message as QoS-Information AVP. The provisioning of the authorized QoS (which is composed of QCI, ARP and bitrates) is performed from the PCRF to the PCEF. The authorized QoS can refer to a PCC rule, to an IP CAN bearer, to a QCI or to an APN.

- When the authorized QoS applies to an IP CAN bearer, it shall be provisioned outside a Charging-Rule-Definition AVP and it shall also include the Bearer-Identifier AVP to indicate what bearer it applies to.
- When the authorized QoS applies to a PCC rule, it shall be provisioned within the corresponding PCC rule by including the QoS-Information AVP within the Charging-Rule-Definition AVP. The QoS-Information AVP shall not contain a Bearer-Identifier AVP.
- When the authorized QoS applies to QCI, authorised MBR per QCI is supplied. In such a case the authorized QoS shall be provisioned outside a Charging-Rule-Definition AVP at the command level. This case applies only for IP-CAN types that support non-GBR bearers that have a separate MBR (i.e. 3GPP-GPRS access). Its applicability is specified in annex A.
- When the authorized QoS applies to an APN, authorised APN-Aggregate-Max-Bitrate UL/DL is supplied. In such a case the authorized QoS shall be provisioned outside a Charging-Rule-Definition AVP at command level. This case applies only for 3GPP-EPS access. See annex B for further details.
- When the authorized QoS applies to the default EPS bearer it shall be provisioned within the Default-EPS-Bearer-QoS AVP.

Authorized QoS at IP-CAN bearer level is access specific. See Annex A for further details.

The authorized QoS provides appropriate values for the resources to be enforced.

The authorized QoS for a PCC rule is a request for allocating the corresponding resources, and the authorized QoS for a QCI is a request for an upper limit for the MBR that the PCEF assigns to non-GBR bearers with that QCI.

The Provisioning of authorized QoS per PCC rule is a part of PCC rule provisioning procedure.

If the PCEF cannot allocate any of the resources as authorized by the PCRF, the PCEF should inform the PCRF using the Event-Trigger AVP with the corresponding value. If network initiated procedures apply for the PCC rule and the corresponding IP-CAN bearer can not be established or modified to satisfy the bearer binding, then the PCEF shall reject the activation of a PCC rule using the Gx experimental result code DIAMETER_PCC_BEARER_EVENT and a proper Event-Trigger value.

The PCEF is responsible for enforcing the policy based authorization.

QoS authorization information may be dynamically provisioned by the PCRF or it can be a pre-defined PCC rule in the PCEF.

The PCEF shall make sure that the total QoS information of the PCC rules for one IP-CAN bearer does not exceed the authorized QoS information, i.e. the information received from the PCRF.

If the PCRF is unable to make a decision for the response to the CC-Request by the PCEF, the PCRF may reject the request as described in subclause 4.5.1.

4.5.5.0a Provisioning of authorized QoS per IP CAN bearer

The authorized QoS per IP-CAN bearer is used if the bearer binding is performed by the PCRF (as defined in [8]). Provisioning of authorized QoS per IP-CAN bearer is access specific. See Annex A for further details.

4.5.5.1 Policy enforcement for authorized QoS per IP CAN bearer

The PCEF is responsible for enforcing the policy based authorization, i.e. to ensure that the requested QoS is in-line with the "Authorized QoS" per IP CAN Bearer. Policy enforcement of authorized QoS per IP-CAN bearer is access specific. See Annex A for further details.

4.5.5.2 Policy provisioning for authorized QoS per service data flow

The Provisioning of authorized QoS per service data flow is a part of PCC rule provisioning procedure, as described in Clause 4.5.2.

The authorized QoS per service data flow shall be provisioned within the corresponding PCC rule by including the QoS-Information AVP within the Charging-Rule-Definition AVP in the CCA or RAR commands. This QoS-Information AVP shall not contain a Bearer-Identifier AVP.

4.5.5.3 Policy enforcement for authorized QoS per service data flow

If an authorized QoS is defined for a PCC rule, the PCEF shall limit the data rate of the service data flow corresponding to that PCC rule not to exceed the maximum authorized bandwidth for the PCC rule by discarding packets exceeding the limit.

The PCEF shall reserve the resources necessary for the guaranteed bitrate for the PCC rule upon receipt of a PCC rule provisioning including QoS information. For GBR bearers the PCEF should set the bearer's GBR to the sum of the GBRs of all PCC rules that are active/installed and bound to that GBR bearer. For GBR bearers the PCEF should set the bearer's MBR to the sum of the MBRs of all PCC rules that are active/installed and bound to that GBR bearer. For non-GBR bearers, when the IP-CAN type supports non-GBR bearers that have a separate MBR (i.e. 3GPP-GPRS), the PCEF may also set the bearer's MBR to the sum of the MBRs of all PCC rules that are active and bound to that non-GBR bearer unless that sum exceeds a possibly provisioned authorized QoS per QCI for the bearer's QCI (see Clause 4.5.5.6). If an authorized QoS per QCI has been provisioned for the bearer's QCI, the PCEF should set the bearer's MBR to the corresponding MBR. The access-specific BS Manager (as included in [8]) within the PCEF receives the authorised access-specific QoS information from the Translation/mapping function. Then the PCEF shall start the needed procedures to ensure that the provisioned resources are according to the authorized values. This may imply that the PCEF needs to request the establishment of new IP CAN bearer(s) or the modification of existing IP CAN bearer(s). If the enforcement is not successful, the PCEF shall inform the PCRF as described in subclause 4.5.5.0.

Upon deactivation or removal of a PCC rule, the PCEF shall free the resources reserved for that PCC rule.

4.5.5.4 Coordination of authorized QoS scopes in mixed mode

Coordination of authorized QoS scopes in mixed mode is access specific. See Annex A for further details.

4.5.5.5 Provisioning of authorized QoS per QCI

When the IP-CAN type supports non-GBR bearers that have a separate MBR (i.e. 3GPP-GPRS) the PCRF may provision an authorized QoS per QCI for non-GBR bearer QCI values. The PCRF shall not provision an authorized QoS per QCI for GBR bearer QCI values.

The authorized QoS per QCI shall be provisioned at RAR or CCA command level using the QoS-Information AVP with the QoS-Class-Identifier AVP and the Maximum-Requested-Bandwidth-UL AVP and/or the Maximum-Requested-Bandwidth-DL AVP. The Guaranteed Bitrate values shall not be filled up. Multiple QoS-Information AVPs can be used for assigning authorized QoS for several QCIs with one command. The authorized QoS per QCI may be provisioned before or in connection with the activation of the first PCC rule with a certain QCI. The PCRF may also provision a changed authorized QoS per QCI at any time.

4.5.5.6 Policy enforcement for authorized QoS per QCI

The PCEF can receive an authorized QoS per QCI for non GBR-bearer QCI values for those IP-CAN types that support non-GBR bearers that have a separate MBR (i.e. 3GPP-GPRS). It sets an upper limit for the MBR that the PCEF may assign to a non-GBR bearer with that QCI. If the PCEF receives an authorized QoS per QCI for a non-GBR bearer QCI value, it shall not set a higher MBR for that bearer than the provisioned MBR. The PCEF should assign the authorized MBR per QCI to a non-GBR bearer with that QCI to avoid frequent IP-CAN bearer modifications as PCC rules can be dynamically activated and deactivated.

If multiple IP-CAN bearers within the same IP-CAN session are assigned the same QCI, the authorized MBR per QCI applies independently to each of those IP-CAN bearers.

The access-specific BS Manager (as included in [8]) within the PCEF receives the authorized access-specific QoS information from the Translation/mapping function.

4.5.5.7 Provisioning of authorized QoS per APN

Provisioning of authorized QoS per APN is 3GPP-EPS access specific. See Annex B for further information.

4.5.5.8 Policy enforcement for authorized QoS per APN

Policy enforcement for authorized QoS per APN is 3GPP-EPS access specific. See Annex B for further information.

4.5.5.9 Provisioning of authorized QoS for the Default EPS Bearer

The PCRF may provision the authorized QoS for the default EPS bearer. The authorized QoS may be obtained upon interaction with the SPR.

The default EPS bearer QoS information shall be provisioned at RAR or CCA command level using the Default-EPS-Bearer-QoS AVP including the QoS-Class-Identifier AVP and the Allocation-Retention-Priority AVP. The provided QoS-Class-Identifier AVP shall include a non-GBR corresponding value.

4.5.5.10 Policy enforcement for authorized QoS of the Default EPS Bearer

The PCEF may receive the authorized QoS for the default bearer over Gx interface. The PCEF enforces it which may lead to the upgrade or downgrade of the subscribed default EPS Bearer QoS.

4.5.6 Indication of IP-CAN Bearer Termination Implications

This procedure applies to those IP-CAN networks that support multiple bearers. This procedure applies only to dedicated bearers. For 3GPP-GPRS IP-CAN network, see annex A.

If the last IP CAN bearer within an IP CAN session is being terminated, the PCEF shall apply the procedures in clause 4.5.7 to indicate the IP CAN session termination.

The PCEF shall inform the PCRF whenever one of these conditions applies.

- There is a bearer resource modification request initiated by the UE that requires the release of resources
- The PCEF is requested to initiate the deactivation of a bearer
- PCC rule(s) are disabled

Based on the response from the PCRF, the PCEF may initiate the termination of the bearer.

The "Indication of IP-CAN Bearer Termination Implications" procedure shall be carried out as part of a Request for PCC rules at IP-CAN session modification. The PCEF shall send a CC-Request with CC-Request-Type AVP set to the value "UPDATE_REQUEST" and shall include the following additional information:

- The PCEF shall include the Charging-Rule-Report AVP with the PCC-Rule-Status set to inactive for the affected PCC rules.

When the PCRF receives the CC-Request indicating the implications of a bearer termination, it shall acknowledge the message by sending a CC-Answer to the PCEF. The PCRF has the option to make a new PCC decision for the affected PCC Rules. Within the CC-Answer, the PCRF may request the removal of the affected PCC rules and provision PCC rules as detailed in clause 4.5.2.

The PCEF shall remove all PCC rules which have not been re-installed.

If no more PCC rules are active as part of the bearer, the PCEF shall initiate the IP-CAN bearer termination procedure.

The PCRF is not aware that it requests the termination of an IP CAN bearer by removing certain PCC rules. If upon removal of the PCC rules, there are no more PCC rules active in the PCEF for an IP-CAN bearer, the PCEF shall initiate the bearer termination procedure.

Signalling flows for the IP-CAN bearer termination and details of the binding mechanism are presented in 3GPP TS 29.213 [8].

4.5.7 Indication of IP-CAN Session Termination

The PCEF shall contact the PCRF when the IP-CAN session is being terminated. The PCEF shall send a CC-Request with CC-Request-Type AVP set to the value "TERMINATION_REQUEST".

When the PCRF receives the CC-Request, it shall acknowledge this message by sending a CC-Answer to the PCEF.

NOTE: According to DCC procedures, the Diameter Credit Control session is being terminated with this message exchange.

Signalling flows for the IP-CAN session termination are presented in 3GPP TS 29.213 [8].

4.5.8 Request of IP-CAN Bearer Termination

This procedure applies to those IP-CAN networks that support multiple bearers. This procedure applies only to dedicated bearers. For 3GPP-GPRS IP-CAN network, see annex A.

As a consequence of the removal of PCC rules initiated by the PCRF, the PCEF may require the termination of an existing bearer. The PCRF may not be aware that it requests the termination of an IP-CAN bearer by removing certain PCC rules.

The PCRF may request the removal of the PCC rules by using the PCC rule provisioning procedures in clause 4.5.2 to remove all PCRF-provisioned PCC rules and deactivate all PCC rules predefined within the PCEF. The PCRF may either completely remove these PCC rules from the IP CAN session or reinstall them (e.g. by changing the QoS or charging information) within the IP CAN session. When all the PCC rules applied to one bearer have been deleted and/or deactivated, the PCEF will instantly start the bearer termination procedure.

If the selected Bearer Control Mode (BCM) is UE-only, and the PCRF receives a trigger for the removal of all PCC rules from the AF, the following steps apply. In order to avoid race conditions, the PCRF should start a timer to wait for the UE-initiated resource release message. If a UE-initiated resource release is performed before timer expiry, the PCRF will receive an Indication of IP-CAN Bearer Termination Implications according to Clause 4.5.6 and shall then not perform the removal of the PCC rules. Otherwise, if the timer expires, the PCRF shall remove/deactivate the affected PCC rules that have been previously installed/activated.

If the selected BCM is UE-only, and the PCRF decides to remove one or more PCC rules due to an internal trigger or trigger from the SPR, the PCRF shall instantly remove/deactivate the affected PCC rules that have been previously installed/activated.

If the selected BCM is UE/NW, and the PCRF removes/deactivates at the PCEF, all PCC rules bound to an IP CAN bearer (due to any trigger), the PCEF shall instantly start the procedures to terminate the related IP-CAN bearer.

If no more PCC rules are applied to an IP CAN bearer, the PCEF shall apply IP CAN specific procedures to terminate the IP CAN bearer, if such procedures exist for this IP CAN type. Furthermore, the PCEF shall apply the indication of IP CAN Bearer Termination procedure in clause 4.5.6.

4.5.9 Request of IP-CAN Session Termination

If the PCRF decides to terminate an IP-CAN session due to an internal trigger or trigger from the SPR, the PCRF shall send an RAR command including the Session-Release-Cause AVP to the PCEF. The PCEF shall acknowledge the command by sending an RAA command to the PCRF and instantly remove/deactivate all the PCC rules that have been previously installed or activated on that IP-CAN session.

The PCEF shall apply IP-CAN specific procedures to terminate the IP-CAN session. Furthermore, the PCEF shall apply the indication of IP-CAN Session Termination procedure in clause 4.5.7.

See Annex A for 3GPP-GPRS access type.

4.5.10 Bearer Control Mode Selection

The PCEF may indicate, via the Gx reference point, a request for Bearer Control Mode (BCM) selection at IP-CAN session establishment or IP-CAN session modification (e.g. as a consequence of an SGSN change). It will be done using the PCC rule request procedure.

At IP-CAN Session Establishment, the PCEF shall supply, if available, the Network-Request-Support AVP in the CC-Request with a CC-Request-Type AVP set to the value "INITIAL_REQUEST". At IP-CAN Session Modification, the PCEF shall supply, if available, the Network-Request-Support AVP in the CC-Request with a CC-Request-Type AVP set to the value "UPDATE_REQUEST". The Network-Request-Support AVP indicates the access network support of the network requested bearer control.

The PCRF derives the selected Bearer-Control-Mode AVP based on the received Network-Request-Support AVP, access network information, subscriber information and operator policy. If the selected bearer control mode is UE_NW, the PCRF shall decide what mode (UE or NW) shall apply for every PCC rule.

NOTE: For operator-controlled services, the UE and the PCRF may be provisioned with information indicating which mode is to be used.

The selected Bearer-Control-Mode AVP shall be provided to the PCEF using the PCC Rules provision procedure at IP-CAN session establishment. The selected value will be applicable for the whole IP-CAN session.

When the bearer binding function is changed from the BBERF to the PCEF, the PCEF may indicate, via the Gx reference point, a request for Bearer Control Mode (BCM) selection at IP-CAN session modification as described above.

NOTE: The bearer binding function can be changed from the BBERF to the PCEF when the UE moves from a case 2a) system or a case 2b) system to a case 1) system (see 3GPP TS 29.213 [8]).

4.5.11 Provisioning of Event Report Indication

For the cases where Gxa and/or Gxc are deployed in the network, the PCEF may indicate the PCRF to be informed about specific changes occurred in the access network. In this case, the PCRF shall subscribe to the appropriate event triggers in the BBERF according to clause 4a.5.8. After receiving the reply of the event subscription from the BBERF, the PCRF shall send the event related information to the PCEF. The Event Report concept is defined in 3GPP TS 23.203 [7] clause 3.1.

When PCRF is notified that an event is triggered in the BBERF, if the PCEF has previously requested to be informed of the specific event, the PCRF shall notify the PCEF about the event occurred together with additional related information. This notification will be done by using the Event-Report-Indication AVP. There may be neither PCC Rules nor Event Triggers in this message.

4.5.12 PCC Rule Error Handling

If the installation/activation of one or more PCC rules fails, the PCEF shall include one or more Charging-Rule-Report AVP(s) in either a CCR or an RAA command as described below for the affected PCC rules. Within each Charging-Rule-Report AVP, the PCEF shall identify the failed PCC rule(s) by including the Charging-Rule-Name AVP(s) or Charging-Rule-Base-Name AVP(s), shall identify the failed reason code by including a Rule-Failure-Code AVP, and shall include the PCC-Rule-Status AVP as described below:

- If the installation/activation of one or more PCC rules fails using a PUSH mode (i.e., the PCRF installs/activates a rule using RAR command), the PCEF shall communicate the failure to the PCRF in the RAA response to the RAR.
- If the installation/activation of one or more PCC rules fails using a PULL mode (i.e., the PCRF installs/activates a rule using a CCA command) the PCEF shall send the PCRF a new CCR command and include the Rule-Failure-Code AVP.

If the installation/activation of one or more new PCC rules (i.e., rules which were not previously successfully installed) fails, the PCEF shall set the PCC-Rule-Status to INACTIVE for both the PUSH and the PULL modes.

Editor's Note: If a PCC rule modification fails (i.e., the PCRF installs a PCC rule which was previously successfully installed) it is FFS whether the PCEF may set the PCC-Rule-Status to ACTIVE or INACTIVE.

If a PCC rule was successfully installed/activated, but can no longer be enforced by the PCEF, the PCEF shall send the PCRF a new CCR command and include a Charging-Rule-Report AVP. The PCEF shall include the Rule-Failure-Code AVP within the Charging-Rule-Report AVP and shall set the PCC-Rule-Status to INACTIVE.

NOTE: The status of the rule must be INACTIVE when reporting an error in a new CCR command since the new CCR/CCA transaction contains no previous state information regarding the definition and status of the rule.

4.5.13 Time of the day procedures

PCEF shall be able to perform PCC rule request as instructed by the PCRF. Revalidation-Time when set by the PCRF, shall cause the PCEF to trigger a PCRF interaction to request PCC rules from the PCRF for an established IP CAN session. The PCEF shall stop the timer once the PCEF triggers an REVALIDATION_TIMEOUT event.

PCRF shall be able to provide a new value for the revalidation timeout by including Revalidation-Time in CCA or RAR

PCRF shall be able to stop the revalidation timer by disabling the REVALIDATION_TIMEOUT event trigger.

If Rule-Activation-Time is specified, then the PCEF shall set the rule active after that time.

If Rule-Deactivation-Time is specified, then the PCEF shall set the rule to be inactive after that time.

PCC Rule Activation or Deactivation will not generate any CCR commands with Charging-Rule-Report since PCRF is already aware of the state of the rules.

If Rule-Activation-Time or Rule-Deactivation-Time is specified in the Charging-Rule-Install then it will replace the previously set values for the specified PCC rules.

The PCC rule shall be inactive when the rule is installed.

The 3GPP-MS-TimeZone AVP, if available, may be used for the PCRF to derive the Rule-Activation-Time and Rule-Deactivation-Time.

Editor's Note: The 3GPP-MS-TimeZone AVP, if available, will be sent to the PCRF during the IP-CAN session establishment. If the UE moves to another time zone, it is FFS how the PCEF reports the updated UE time zone information to the PCRF. It is FFS if the UE time zone information is needed over Gxx from the BBERF.

Editor's Note: BBERF interaction for time of the day updates is TBD.

4a Gxx reference points

Editor's note: The structure of this clause may change

4a.1 Overview

The Gxx reference point is located between the Policy and Charging Rules Function (PCRF) and the Bearer Binding and Event Reporting Function (BBERF). Gxc applies when the BBERF is located in the S-GW and Gxa applies when the BBERF is located in a trusted non-3GPP access. The Gxx reference point is used for:

- Provisioning, update and removal of QoS rules from the PCRF to the BBERF
- Transmission of traffic plane events from the BBERF to the PCRF.
- Transmission of events reported by the PCEF to the BBERF via the PCRF.

The stage 2 level requirements for the Gxx reference point are defined in 3GPP TS 23.203 [7] and 3GPP TS 23.402 [23].

Signalling flows related to Rx, Gx and Gxx interfaces are specified in 3GPP TS 29.213 [8].

Gxx reference point does not apply for 3GPP-GPRS Access Type.

4a.2 Gxx Reference model

The Gxx reference point is defined between the PCRF and the BBERF. The BBERF is located in the AN-Gateway. The AN-Gateway is the S-GW when Gxc applies and it is the trusted non-3GPP access gateway when Gxa applies. The relationships between the different functional entities involved are depicted in figure 4a.2.1

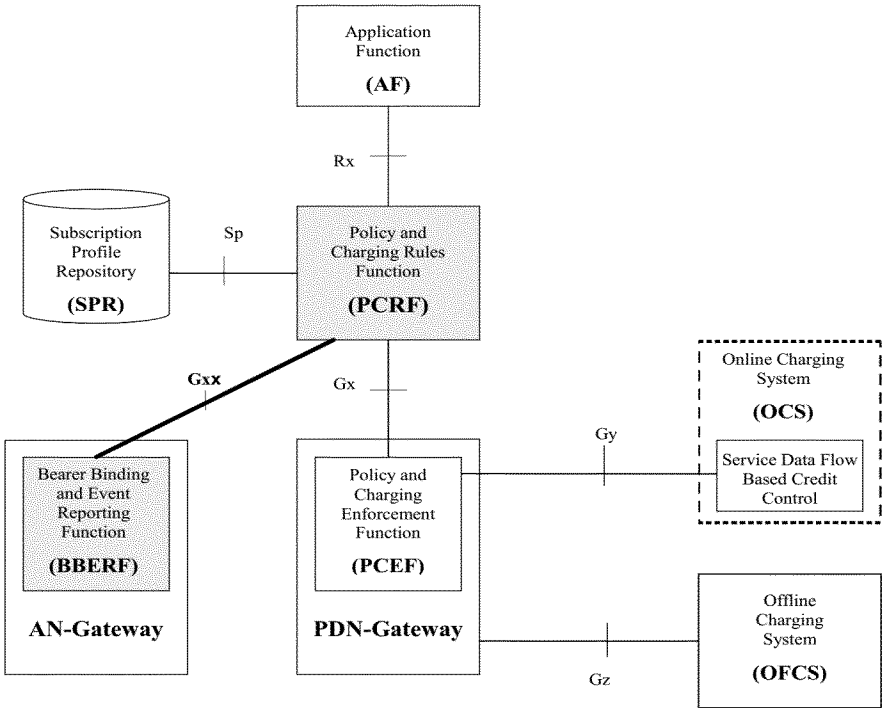


Figure 4a.2.1: Gxx reference point at the Policy and Charging Control (PCC) architecture

NOTE: The details associated with the Sp reference point are not specified in this Release. The SPR's relation to existing subscriber databases is not specified in this Release.

4a.3 Quality of Service Control Rules

4a.3.1 Quality of Service Control Rule Definition

The purpose of the Quality of Service Control rule (QoS rule) for the BBERF is to:

- Detect a packet belonging to a service data flow.
- The service data flow filters within the QoS rule are used for the selection of downlink IP CAN bearers.
- The service data flow filters within the QoS rule are used for the enforcement that uplink IP flows are transported in the correct IP CAN bearer.
- Identify the service the service data flow contributes to.

For an IP-CAN session, the QoS rules are derived from the PCC rules. The QoS rule shall contain the same service data flow template, precedence and QoS information as the corresponding PCC rule. For case 2a (as defined in [8]), the QoS rules that are derived from a PCC rule shall contain the applicable tunnelling header information.

NOTE: During the course of a BBERF relocation procedure, the QoS rules in the non-primary BBERF might not be consistent with the PCC rules in the PCEF.

For case 2a (as defined in [8]) there can be also QoS rules that do not apply to the IP-CAN session and that are local to the access system, thus not having any corresponding PCC rule. These QoS rules shall not have any associated tunnelling header information.

The BBERF shall select a QoS rule for each received packet by evaluating received packets against in this order:

- if present, the tunnelling header information
- the service data flow filters of QoS rules, associated with the matching tunnelling header information, in their order of the precedence.
- service data flows filters of QoS rules not associated with any tunnelling header info.

When a packet matches a service data flow filter, the packet matching process for that packet is completed, and the QoS rule for that filter shall be applied.

A QoS rule consists of:

- a rule name;
- service data flow filter(s);
- precedence;
- QoS parameters;

The rule name shall be used to reference a QoS rule in the communication between the BBERF and the PCRF.

The service flow filter(s) shall be used to select the traffic for which the rule applies.

The QoS information includes the QoS class identifier (authorized QoS class for the service data flow), the ARP and authorized bitrates for uplink and downlink.

For different QoS rules with overlapping service data flow filter, the precedence of the rule determines which of these rules is applicable.

4a.3.2 Operations on QoS Rules

The following operations are available:

- Installation: to provision a QoS rule that has not been already provisioned.
- Modification: to modify a QoS rule already installed.
- Removal: to remove a QoS rule already installed.

The procedures to perform these operations are further described in clause 4a.5.2.

4a.4 Functional elements

4a.4.1 PCRF

The PCRF has been already specified in clause 4.4.1. Particularities for the Gxx reference point are specified in this clause.

The PCRF shall provision QoS Rules to the BBERF via the Gxx reference point.

The PCRF shall provide QoS rules with identical service data flow templates as provided to the PCEF in the PCC rules. If the service data flow is tunnelled at the BBERF, the PCRF shall provide the BBERF with mobility protocol tunnelling header information received from the PCEF to enable the service data flow detection in the mobility tunnel at the BBERF.

The PCRF QoS Rule decisions may be based on one or more of the following:

- Information obtained from the AF via the Rx reference point, e.g. the session, media and subscriber related information.
- Information obtained from the PCEF via the Gx reference point, e.g. IP-CAN bearer attributes, request type and subscriber related information.
- Information obtained from the SPR via the Sp reference point, e.g. subscriber and service related data.
- Information obtained from the BBERF via the Gxx reference point.

The PCRF shall inform the BBERF through the use of QoS rules on the treatment of each service data flow that is under PCC control, in accordance with the PCRF policy decision(s).

Upon subscription to loss of AF signalling bearer notifications by the AF, the PCRF shall request to BBERF to be notified of the loss of resources associated to the QoS Rules corresponding with AF Signalling IP Flows, if this has not been requested previously to the BBERF. In this case, PCRF will not subscribe to this event in the PCEF.

The PCRF shall, based on information reported from BBERF and PCEF, determine the Gx session(s) that shall be linked with a Gateway Control session.

4a.4.2 BBERF

The BBERF (Bearer Binding and Event Reporting Function) is a functional element located in the S-GW when Gxc applies and in a trusted non-3GPP access when Gxa applies. It provides control over the user plane traffic handling and encompasses the following functionalities:

- Bearer binding: For a service data flow that is under QoS control, the Bearer Binding Function (BBF) within BBERF shall ensure that the service data flow is carried over the bearer with the appropriate QoS class. The ARP, GBR, MBR and QCI are used by the BBERF in the same way as in the PCEF for resource reservation.
- Uplink bearer binding verification.
- Event reporting: The BBERF shall report events to the PCRF based on the event triggers installed by the PCRF.
- Service data flow detection for tunnelled and untunnelled SDFs: The BBERF uses service data flow filters received from the PCRF for service data flow detection.